# Discovery of adhesion ligands for pluripotent human stem cells

## Grant Award Details

Discovery of adhesion ligands for pluripotent human stem cells

**Grant Type:** Tools and Technologies I

**Grant Number:** RT1-01097

**Investigator:**

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| **Name:** | Kit Lam |
| **Institution:** | University of California, Davis |
| **Type:** | PI |

**Human Stem Cell Use:** Embryonic Stem Cell, iPS Cell

**Award Value:** $834,003

**Status:** Closed

## Progress Reports

**Reporting Period:** Year 2

**View Report**

## Grant Application Details

**Application Title:** Discovery of adhesion ligands for pluripotent human stem cells

**Public Abstract:**

We have assembled a team of investigators with complementary expertise in applying the state-of-the-art "one-bead-one-compound" (OBOC) combinatorial library methods to identify synthetic chemical molecules that bind to unique receptors (protein molecules) on the surface of human embryonic stem cells and induced pluripotent stem cells. In this technology, stem cells will be mixed with huge number of chemical-beads (1,000,000 or more), and those beads coated by the stem cells will be isolated for chemical analysis. We believe some of the chemical molecules identified by this method will support the growth and proliferation of stem cells while maintaining their "stemness" nature (self-renewal). Other molecules may induce directed-differentiation into specific desirable cell types such as heart cells for damaged heart and brain cells for patients who suffer stroke. Once these molecules are identified, we shall incorporate them into an artificial gel that can support large scale stem cell growth and directed-differentiation. Such artificial gels are free of animal products and viruses, making them safe for therapeutic use in human. We shall take advantage of these novel molecules and gels to study and therefore understand how stem cells work. These molecules may also be used as imaging probes to track or localized stem cells inside patients. For tissue regeneration, we may incorporate one or more of these molecules onto surfaces of biodegradable scaffolding with predetermined shape, so that simple artificial organs with various cell types can be developed. These molecules may also serve as very important tools and reagents for basic stem cell research.

**Statement of Benefit to California:**

We have assembled a team of investigators with complementary expertise in applying the state-of-the-art "one-bead-one-compound" (OBOC) combinatorial library methods to identify peptide, peptdomimetic, or small molecule ligands that bind to unique receptors on the hESC/iPSC surface. We anticipate that some of these ligands can support the self-renewal and/or pluripotency of hESC/iPSC, while others are capable of inducing specific cell signaling to promote directed differentiation and facilitated maturation of such lineage-specific derivatives as cardiomyocytes. Since D-amino acids, unnatural amino acids, and other small molecule building blocks will be used in the construction of our chemical libraries, the hESC/iPSC-specific ligands identified in this research are expected to be resistant to proteolysis. We envision that these ligands will be invaluable for basic and translational hESC/iPSC research. For instance, when immobilized in a solid support or gel matrix, these ligands (individual or a mixture) could function as an artificial extracellular matrix for promoting self-renewal, pluripotency, (cardiac) differentiation or maturation. Such functionalized scaffold will be useful for tissue engineering, tissue regeneration, stem cell and lineage purification (e.g. cardiomyocytes from a mixture of cell types present in differentiation guided extraction of resident stem cells). High-specificity and high-affinity ligands can also be used for in vivo tracking of stem cells and their derivatives. For example, the ligand can be radiolabeled with 64Cu or 18F, injected i.v. into the patient or experimental subject, and the specific cells recognized will be localized by PET scan. Indeed, we have already successfully used such approach for in vivo imaging of ovarian and lymphoid cancers in xenograft models. Similar to monoclonal antibodies, hESC/iPSC/CM-specific ligands can also be use as reagents in flow cytometry analysis of stem cells.

Many of the technologies that have been or to be developed in this research will not only benefit patients in California, but will also lead to commercialization and establishment of new biotechnology companies in California, and therefore economic growth of our state.

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